00095

THE OPEN UNIVERSITY OF SRI LANKA

B. Sc. DEGREE PROGRAMME 2017 / 2018

LEVEL 5 - FINAL EXAMINATION

CYU5306 - BIOCHEMISTRY

DURATION: 02 HOURS

Date: Thursday 18th April 2019 Time: 1.30-3.30 pm

Instructions to candidates: Answer ALL FOUR (04) questions.

1) Answer any **Two (02)** parts from **(A) – (C).**

A) i) What do you understand by catabolic pathways?

ii) Briefly describe two types of catabolic pathways of glucose.

iii) What are the importances of citric acid cycle in energy metabolism?

iv) Give three main metabolic pathways which are involved in producing acetyl CoA.

v) Explain one of the oxidative decarboxylation steps in the citric acid cycle. Explain the relevant complete reactions including enzymes and reducing equivalents. (Hint: Chemical structures of these compounds are not necessary)

(50 marks)

B) i) State the importance of the cellular locations of the citric acid cycle and the respiratory chain.

ii) The respiratory chain is a process which occurs in the mitochondrion. State the names of the two pathways by which NADH enter the respiratory chain.

iii) Between two pathways mentioned in (ii), one pathway gives a higher number of ATP molecules from NADH than the other pathway. Explain.

iv) State the role of each protein complex of the respiratory chain.

(50 marks)

C) i) The conversion of pyruvate to lactate involves NADH, an example for transfer of electrons. Using the E^0 values given below, deduce the direction of electron flow.

$$\text{Pyruvate} + 2H^+ + 2e \longrightarrow \text{Lactate} \quad E^0 = -0.185V$$

$$NAD^+ + H^+ + 2e \longrightarrow NADH \quad E^0 = -0.320V$$

ii) What is meant by photolysis?

iii) Name the photosynthetic process that occur in two stages.

iv) Compare and contrast these two stages of the photosynthetic process.

v) What are the two photosystems found in chloroplast? Briefly explain the events take place when electrons flow through these two photosystems.

(50 marks)

2) Answer any **Two (02)** parts from **(A) – (C)**

A) i) What is an active site of an enzyme? What are the forces that help to drawn substances to the active site? List three (03) of them.

ii) Describe two theories on how an enzyme binds to the substrate to the active site.

iii) What is meant by optimum temperature of an enzyme? Why does the rate decreases beyond the optimum temperature?

(50 marks)

B) Michealis-Menten equation for enzyme- catalyzed reaction is as follows.

$$V = \frac{V_{max}[S]}{K_m + [S]}$$

i) Sketch the M-M plot of V vs [S] using above equation.

ii) Derive the expression and sketch Lineweaver – Burk double reciprocal plot using above M-M equation.

iii) Michealis-Menten equation for uncompetitive inhibition is,

$$V_0 = \frac{V_{max}[S]}{K_m + \alpha'[S]}$$

Define α' of the above expression and derive the expression to draw Lineweaver Burk plot for uncompetitive inhibition.

(50 marks)

C) i) List down four important characteristics of allosteric enzymes.

ii) Describe the two models put forward to explain sigmoidal kinetics.

iii) What do you mean by reciprocal regulation?

(50 marks)

3) Answer any **Two (02)** parts from **(A) – (C)**

A) i) Glycolytic pathway is consisted of two major phases. Name the two phases and state their significance.

(10 marks)

ii) There are five steps required for the conversion of Glucose to dihydroxyacetone phospahate (DHAP) in the Glycolytic pathway. Explain the above process indicating products and the enzymes required at each step.

(Hint: Chemical structures of these compounds are not necessary)

(25 marks)

iii) The breakdown of glucose up to the citric acid cycle can be given as

$$\text{Glucose} + 10NAD^+ + 4ADP + 2H_2O + 4Pi + 2FAD \longrightarrow 6CO_2 + 10NADH + 4ATP + 2FADH_2 + 6H^+$$

Calculate the total yield of ATP from the above equation per mole of Glucose.

(15 marks)

B) i) Why is glucose considered as a store for energy production rather than the fat stores?

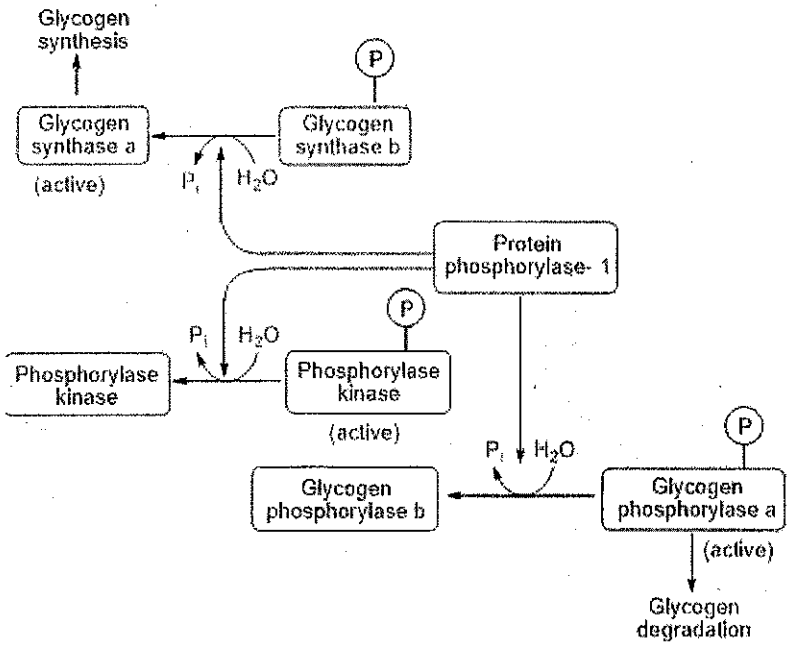
(10 marks)

ii) Describe the functions of the glycogen debranching enzyme in glycogenolysis.

(20 marks)

iii) Glycogen metabolism given below is controlled by insulin hormone. Which enzyme is activated by insulin hormone in the given reaction scheme? Explain why insulin deficiency causes diabetes according to the given reaction scheme.

(20 marks)



C) Gluconeogenesis shares only some steps of glycolysis. Therefore, gluconeogenesis is not the reverse of glycolysis.

i) Explain the first by pass reaction of gluconeogenesis, production of phosphoenolpyruvate (PEP) from pyruvate.

(25 marks)

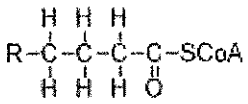
ii) Explain how glycerol is used in gluconeogenesis to synthesize glucose.

(25 marks)

4) i) In β-oxidation, the fatty acylCoA formed in the cytosol is transported into the mitochondrion for the oxidation process. Explain the process of transporting fatty acylCoA from cytosol to the mitochondrion.

(20 marks)

ii) Explain the production of acetylCoA by one cycle of oxidation of the given fatty acetylCoA in the β-oxidation pathway with the aid of structure given below.



(Hint: Chemical structures of the relevant compounds are necessary)

(24 marks)

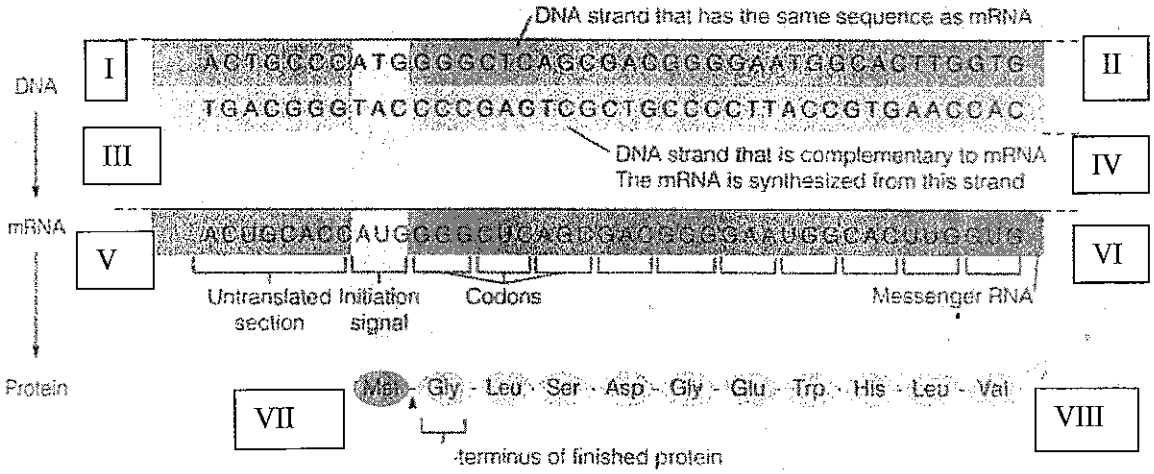
iv) Define the terms transamination and oxidative deamination and compare the two processes.

(20 marks)

iv) Explain the steps of how alanine transports nitrogen from the tissues to the liver.

(20 marks)

v) Label the ends of the DNA, RNA and Amino acids chain (empty boxes labelled I to VIII) with the appropriate designation (5', 3', N-terminus, C-terminus)



(16 marks)